

Market Factors Affecting Fuel Ethanol Production

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Abstract: Fuel ethanol production has varied sharply over the past 2 years. This paper analyzes price relationships among corn and corn milling coproducts, ethanol, and gasoline to describe market forces that are likely to affect the supply and demand for fuel ethanol.

Keywords: Ethanol, corn, coproducts, oxygenates, gasoline, prices, costs.

Fuel ethanol producers have taken a wild ride since production reached record highs in late 1994 and early 1995. With corn prices at or near record levels for an extended period during the 1995/96 crop year, ethanol producers were squeezed and fuel ethanol production dropped to 39,000 barrels per day by July 1996, a full 60 percent below the high of 100,000 barrels per day in January 1995. What market forces precipitated such a production decrease, and what did we learn about how ethanol producers may react to future changes in commodity prices?

Over 60 percent of all fuel ethanol is blended into conventional gasoline as a fuel extender or octane enhancer. The remaining 40 percent is blended into conventional gasoline and reformulated gasoline as oxygenate. Oxygenates are required in both reformulated gasoline and oxygenated fuels although fuel producers can choose oxygenates based on their blending economics. Decisions on which oxygenates to use in mandated programs are based on the relative prices among oxygenates. For example, ethanol is used in about 70 percent of the reformulated gasoline sold in Chicago because it is more economical to use than methyl tertiary butyl ether (MTBE), its main competitor. Oxygenates are not required in conventional gasoline, so a decision to blend ethanol into conventional gasoline is based strictly on the relationship between ethanol and gasoline prices. Thus, ethanol blending margins for gasoline suppliers are an important market factor to consider in this analysis.

Because a large percentage of ethanol is blended into conventional gasoline, we would expect the relationship between ethanol and gasoline prices to be a determining factor in the amount of ethanol demanded. Fuel producers receive an incentive for blending ethanol into gasoline through a partial exemption of the Federal gasoline excise tax. The incentive is equivalent to \$0.54 for every gallon of ethanol blended. When the difference between gasoline and ethanol prices is roughly \$0.54 per gallon, gasoline suppliers begin to have an economic incentive to use ethanol.² Thus, when the difference between ethanol and wholesale gasoline prices is greater than \$0.54 cents per gallon, ethanol blending margins are negative and we would expect gasoline suppliers to blend less

ethanol. When the difference is less than \$0.54 per gallon, ethanol blending margins are positive and we expect gasoline suppliers to blend more ethanol.

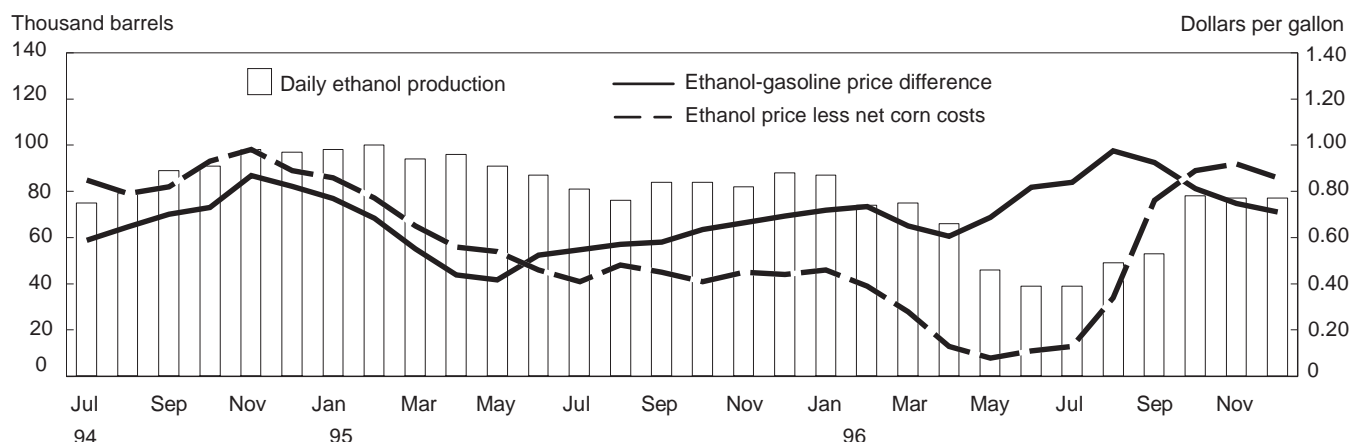
Ethanol producers process corn into ethanol and other products. Ethanol wet mills produce corn oil, corn gluten feed (CGF), corn gluten meal (CGM), and dry mills produce distillers' dried grains (DDG). The profitability of ethanol production not only depends on the gross price of corn, but also on the prices of all products made from the corn. A major factor affecting producers' decisions to process corn into ethanol is the net cost of corn for each gallon of ethanol produced. Net corn costs of ethanol for wet mills are defined as the price of corn per bushel minus the price of CGF times the amount of CGF produced per bushel, minus the price of corn oil times the amount of oil produced per bushel, minus the price of CGM times the amount of CGM produced per bushel. Dividing this sum by the yield, 2.5 gallons per bushel, converts to the net corn cost per gallon. When net corn costs increase relative to ethanol prices, producers' margins are squeezed and there is less incentive to produce ethanol than when net corn costs fall relative to ethanol prices. Ethanol production margins are another important market factor to consider in this analysis.

Preliminary statistical analysis indicates that the difference between ethanol and gasoline prices (blending margin), and ethanol and net corn costs (production margin), largely determines the level of ethanol production. The chart illustrates these relationships. One line on the chart plots the difference between ethanol and wholesale gasoline prices by month from June 1994 through December 1996. A second line plots the difference between ethanol prices and net corn costs per gallon of ethanol for the same period. The bars show daily ethanol production in thousand barrels. During June 1994-May 1995, the economics of ethanol production and ethanol blending were working in opposite directions. Blending margins represented by the difference between ethanol and wholesale gasoline prices increased for the first 5 months of that period before beginning a sharp 6-month decline during which ethanol blending economics were very favorable. During that same period, ethanol margins represented by the difference

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²Octane values for ethanol make the break-even price for ethanol vary, sometimes by several cents per gallon.

Figure A-1

Factors Affecting Ethanol Production

Source: Information Resources Incorporated (IRI) and USDA.

between ethanol prices and net corn costs increased slightly in the first 5 months but then also took a sharp decline that lasted for 20 months.

During November 1994-May 1995 blending margins were made favorable by rising gasoline prices and falling ethanol prices. Over the same period, production margins were declining because corn prices were rising and the prices of ethanol and feed coproducts were not keeping pace. The economic forces affecting supply and demand for ethanol were working in opposite directions, one tending to increase demand, the other pushing to reduce supply. If the seasonal variation for ethanol production is accounted for, ethanol production remained about constant or declined slightly during July 1994-May 1995.

In May 1995, the economics of ethanol blending and production margins began to change significantly. Production margins continued to decline sharply until they reached a low of \$0.08 per gallon in May 1996 as corn prices rose sharply. At the same time, blending margins worsened as the difference between ethanol and wholesale gasoline remained consistently above \$0.60 per gallon. With economic forces reducing both demand for and supply of ethanol, production that was already about 10 percent lower than a year earlier began declining sharply in December 1995. By July ethanol production had hit a low of 39,000 barrels per day, or less than 600 million gallons on an annual basis.

Falling corn prices and increasing gasoline prices toward the end of 1996 turned the economic fortunes back in ethanol's favor. Blending margins, while not good, have improved substantially from last summer when gasoline was nearly \$1.00 per gallon cheaper than ethanol. When blending margins were this poor, it is likely that most of the ethanol blended was in reformulated gasoline markets where ethanol competes with MTBE. Because gasoline, natural gas, and MTBE prices were all climbing throughout 1996, ethanol could remain competitive with MTBE in oxygen-mandated areas.

Production margins have greatly improved with net corn costs back under \$0.50 per gallon. Fuel ethanol production followed these signals and increased sharply in August, September, and October, but has remained level through January 1997. One reason may be due to adjustments made by the industry while ethanol production economics were poor. Many producers shut down plants for repairs and additions during the 1996 summer slump. Several producers added equipment making them capable of producing ethanol for a strong beverage alcohol market. Sales into this market, with surging exports, could help explain why fuel ethanol production levels remain lower than they were a year ago. Given the experiences ethanol producers have had over the past 28 months, a little diversification may help smooth the way ahead.